REMARKS

The rejection of claims 1-28 under 35 USC 103(a) as being unpatentable over Bogner et al. (US 2003/0020101) in view of Brese et al. (US 5,643,496) is respectfully traversed.

It is axiomatic that obvious is determined with respect to the invention ***as a whole***.

> In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. MPEP §2141.02(I) (emphasis in original)

The Applicant respectfully asserts that the Examiner's analysis at least with respect to claims 1-16 has omitted a very important part of the claims — that the claimed invention is an **electroluminescent lamp**. Electroluminescent lamps are described in the Applicant's specification at paragraph 16 and shown in Figure 1. Most importantly, electroluminescent lamps use electroluminescent phosphors, i.e., phosphors that are stimulated to emit light by the application of an electric field. *See*, *Specification*, paragraph 1 and *IES Lighting Handbook*, p. 2-11 (1972) (attached).

Bogner et al. relates to light emitting diodes (LEDs) and phosphors for use with LEDs. LEDs are solid state devices which — most importantly — do not use the electroluminescent phosphors found in electroluminescent lamps. LEDs use a doped p-n junction that emits light when a low-voltage, direct current is applied. *See, IES Lighting Handbook*, p. 2-11 (1972). To supplement the emission from the LED, Bogner et al. uses a **photoluminescent** rare-earth activated silicon nitride phosphor to convert a portion of the light emitted by the LED to another color. *See, e.g.*, paragraphs 0001 and 0008. A photoluminescent phosphor is stimulated to emit light through the absorption of photons. In the case of Bogner et al., the phosphor absorbs the blue photons emitted by the LED and emits a longer wavelength yellow-to-red photon. There is no teaching or suggestion in Bogner et al. that it would be desirable to use a blend of an electroluminescent phosphor and the photoluminescent phosphor. In fact, such a combination would be detrimental to the LED of Bogner et al. since blending an electroluminescent phosphor with the photoluminescent phosphor would likely reduce the light output from the LED because the electroluminescent phosphor would not be stimulated to emit light by the blue photons emitted by the LED. *See*, MPEP §2143.01(V) ("If proposed modification would render the prior

art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *citing In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

With respect to claims 17-28, the same arguments apply. There is no teaching or suggestion in Bogner et al. to mix the photoluminescent phosphor described therein with an electroluminescent phosphor. Paragraph 0051 cited by the Examiner clearly refers to a blend of photoluminescent phosphors wherein the phosphors are excited by an UV-radiation emitting source. In addition, the other lamps described by Bogner et al. in Paragraphs 0001 and 0014, high intensity discharge lamps and fluorescent lamps, are also not electroluminescent lamps. Therefore, since neither Bogner et al. nor Brese et al. teach or suggest making the claimed electroluminescent lamp and phosphor blend , the Applicant respectfully asserts that the claimed invention is not obvious in view of Bogner et al. and Brese et al.

In view of the foregoing amendment, it is believed that the Examiner's rejections have been overcome and that the application is in condition for allowance. Such action is earnestly solicited.

Respectfully submitted,

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IES LIGHTING HANDBOOK

The Standard Lighting Guide

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visible light by the use of phosphors. With certain special phosphors it is possible to convert alternating current energy directly into light without using this intermediate step by utilizing the phenomenon of electroluminescence.

Cathodoluminescence. Cathodoluminescence is light emitted when a substance is bombarded by cathode rays. If the energy is from the anode, the phenomenon is called anodoluminescence.

Electroluminescent Lamp (AC Capacitive). An electroluminescent lamp is composed of a conductor (transparent or opaque) unto which a dielectric-phosphor mixture is laid. A second conductor, of transparent material, is deposited over the dielectric-phosphor mixture. An electric field is now capable of being generated between the two conductors.

The electrons in electroluminescent phosphors are excited to higher energy levels by the influence of rapidly fluctuating, high potential radiant fields. Their spontaneous return to lower levels results in the emission of visible light. The light is in the form of broad bands just as in the case of fluorescent phosphors.

Fig. 2–17 shows the cross-section of a lamp diagrammatically, while Fig. 2–18 gives the properties of some electroluminescent phosphors.

The color of light emitted by the electroluminescent lamp is somewhat dependent on frequency, while the luminance is strongly dependent on both voltage and frequency. The effects of both voltage and frequency change with the specific phosphors. The present efficacy is low compared even to incandescent lamps, though comparable to colored incandescent with filter coats giving blue or green light.

Light Emitting Diodes. Light emitting diodes (LED), also called solid state lamps (SSL), produce light by electroluminescence when low-voltage direct current is applied to a suitably doped crystal containing a p-n junction. The phenomenon has been observed as early as 1923 in naturally occurring junctions but was not considered practical due to the low luminous efficacy in converting electric energy to light. Recently it was discovered that under certain conditions the conversion was significant.

The efficacy is dependent upon the visible energy generated at the junction and losses due to reabsorption when light tries to escape through the crystal. Due to the high index of refraction of most semiconductors, light is re-reflected back from the surface into the crystal and highly attenuated before finally exiting. The term used to express this ultimate measurable visible energy is "external" efficacy. While external efficacies are moderate, internal efficacies are calculated to be very high.

Gas Laser. In a solid laser there are three requirements—a material which reacts energetically to light, a population inversion generated by pumping in energy at the proper energy level, and a growth of the internal energy caused by the reflection of photons within the solid. While the same requirements are met in a gas laser, two other characteristics are available—strong, narrow spectral lines and unequal emission at different energy levels. An example of such a gas laser is that containing a mixture of helium and neon. See Fig. 2–19. Helium is used as the energizing gas since it has a level of energy at which it can lose energy only by collision. This level corresponds to the level at which neon radiates energy in the form of red light. By energizing helium in a gas discharge inside a cavity whose ends are reflecting and containing both helium and

Fig. 2–17. Diagrammatic cross-section of an electroluminescent lamp.

Fig. 2–18. Properties of Some Electroluminescent Phosphors

Material	Activators	Color of Light
Cubic zinc sulfide	Copper (low), lead	Blue
Cubic zinc sulfide	Copper (high), lead	Green
Cubic zinc sulfide	Copper (high), lead, manganese	Yellow
Hexagonal zinc sulfide	Copper (very high)	Green
Hexagonal zinc sulfide	Copper (very high), manganese	Yellow
Zinc sulfo selenide	Copper	Green to yellow
Zinc cadmium sulfo selenide	Copper	Yellow to pink

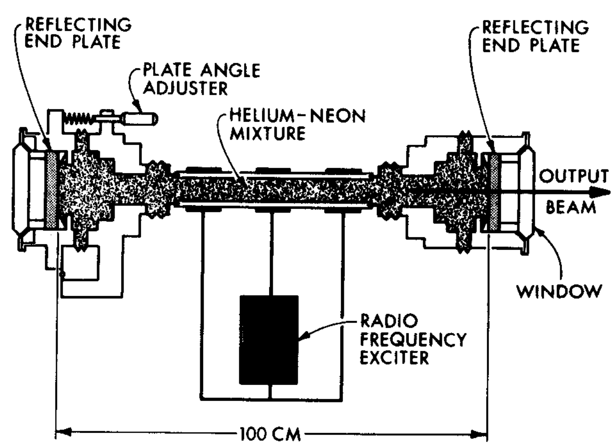

Fig. 2–19. Structure of CW helium-neon gas laser, showing essential parts.* Operation of a gas laser depends on the right mixture of helium and neon gases to provide an active medium. Radio frequency exciter puts energy into the medium. The output beam is built up by repeated passes back and forth between reflecting end plates.[12]

* Adapted from *Scientific American*.